

1 CLAIMS:

2 1. A cylindrical magnetron comprising:

3 a target tube;

4 a first endblock comprising:

5 a motor;

6 a gearbox; and

7 a drive assembly between the gearbox and the target tube with one or more  
8 axially compliant interfaces between gears of the drive assembly such that the  
9 assembly accommodates imperfect rotation of the target tube.

1 2. The magnetron of claim 1 further comprising:

2 a second endblock comprising:

3 an inner housing comprising:

4 a water cooled spindle

5 an electrical transfer system including brush blocks contacting the  
6 surface of the spindle.

7 an outer housing;

8 compliant seal rings between the inner and outer housing whereby the  
9 inner housing can move within the outer housing to absorb imperfect rotation of the target  
10 tube.

1 3. The magnetron of claim 1 further comprising:

2 an inner housing within the first endblock, the gearbox and drive assembly  
3 within the inner housing;

4 an outer housing; and

5 compliant seal rings between the inner and outer housing whereby the  
6 inner housing can move within the outer housing to absorb imperfect rotation of  
7 the target tube.

1 4. The magnetron of claim 3 wherein the imperfect rotation of the target tube  
2 includes eccentric rotation about the axis of rotation of the target tube or movement of the  
3 target tube along the axis of rotation.

1 5. The magnetron of claim 1 wherein the drive assembly comprises first, second and  
2 third gears, the rotating motion from the gearbox transferred from the gearbox to the first  
3 gear, the rotating motion from the first gear transferred to the second gear, and the  
4 rotating motion from the second gear transferred to the third gear.

1 6. The magnetron of claim 5 wherein the second gear is located between the first and  
2 third gear and is electrically insulating.

1 7. The magnetron of claim 5 wherein an axially compliant interface of the one or  
2 more axially compliant interfaces is between the first and second gear.

1 8. The magnetron of claim 5 wherein an axially compliant interface of the one or  
2 more axially compliant interfaces is between the second and third gear.

1 9. The magnetron of claim 5 wherein the third gear is coupled to the target tube.

1 10. The magnetron of claim 5 wherein the first gear has one or more slots, and  
2 wherein one or more protrusions of the gearbox rotate freely within the slots until  
3 encountering the end of the slot and thereafter rotate the entire third component.

1 11. The magnetron of claim 10 wherein the one or more protrusions are aligned  
2 anywhere within the one or more slots during assembly of the magnetron.

1 12. A sputtering device having a rotating target tube suspended between first and  
2 second endblocks, the first endblock having a suspension and drive system comprising:

3 a primary housing;

- 4 a secondary housing held within the primary housing by insulative and  
5 pliable components such that the secondary housing can move within the primary  
6 housing, the secondary housing comprising a system of interlocking male and  
7 female components rotating about an axis and coupling the gearbox to the target  
8 tube.
- 1 13. The sputtering device of claim 12 wherein the first endblock further comprises a  
2 gearbox held within the primary housing by insulative and pliable components such that  
3 the gearbox can move within the primary housing.
- 1 14. The sputtering device of claim 12 wherein the interlocking male and female male and  
2 female components are free to move with six degrees of freedom about the axis of  
3 rotation.
- 1 15. A device for plasma coating a substrate having a target tube that rotates about an  
2 axis of rotation, the device comprising:  
3 a motor;  
4 a gearbox;  
5 a driveline linking the gearbox and the target tube, the driveline able to pivot  
6 about the axis of rotation.
- 1 16. The device of claim 15 wherein the driveline comprises one or more male and one  
2 or more female interconnecting components
- 1 17. The device of claim 16 wherein one of the male or female interconnecting  
2 components is made of an insulating material thereby insulating the motor and gearbox  
3 from the target tube.
- 1 18. The device of claim 15 wherein the driveline is further able to move along the  
2 axis of rotation to absorb imperfect rotation of the target tube.
- 1 19. The sputtering device of claim 15 further comprising a rotating shaft that transfers  
2 power to the target tube.

- 1 20. The sputtering device of claim 19 further comprising one or more brush  
2 blocks that transfer power to the rotating shaft.
- 1 21. The sputtering device of claim 20 wherein the one or more brush blocks are  
2 concentrically disposed about the rotating shaft, and are compressively kept in contact  
3 with the shaft.
- 1 22. The sputtering device of claim 19 wherein cooling water flows through the  
2 rotating shaft and into the target tube.
- 1 23. The sputtering device of claim 19 wherein a non rotating shaft is within the  
2 rotating shaft, and wherein the non rotating shaft locates and supports a magnetic array  
3 within the target tube.
- 1 24. The sputtering device of claim 15 further comprising a shield connected to the  
2 primary housing and electrically isolated from the primary housing.
- 1 25. The sputtering device of claim 24 wherein the shield comprises an inner shield  
2 and an outer shield electrically isolated from each other.
- 1 26. A device for plasma coating a substrate having a target tube that rotates about an  
2 axis of rotation, the device comprising:
- 3 an electrical transfer system capable of transferring power to the target tube, the  
4 transfer system comprising:
- 5 a shaft electrically contacting and rotating with the target tube;
- 6 a brush block in contact with a first region of the shaft,
- 7 wherein water flows through the shaft and the target tube, and wherein the brush  
8 block transfers the power to the shaft and wherein current travels in a path from the  
9 brush block through the shaft to the target tube; and
- 10 a non-metallic bearing in the current path and disposed about a second region of  
11 the shaft.

- 1 27. The device of claim 26 wherein the electrical transfer system is capable of  
2 transferring both alternating and direct current.
- 1 28. The device of claim 26 wherein the second region of the shaft is coated with  
2 chromium oxide.
- 1 29. The device of claim 28 wherein the chromium oxide is diamond polished.
- 1 30. The device of claim 26 wherein the shaft is made of 304 stainless steel thereby  
2 minimizing the effects of inductive heating.
- 1 31. The device of claim 26 wherein the non-metallic bearing is a ceramic bearing that  
2 does not inductively heat.
- 1 32. The device of claim 26 further comprising first and second vacuum seals disposed  
2 about the second region of the shaft.
- 1 33. The device of claim 32 wherein the first and second vacuum seals are made of a  
2 non metallic material that does not inductively heat.
- 1 34. The device of claim 32 further comprising a switch to detect a breach between the  
2 first and second vacuum seals.
- 1 35. The device of claim 26 further comprising first and second water seals disposed  
2 about a third region of the shaft, the third region coated with chromium oxide.
- 1 36. The device of claim 35 further comprising a switch to detect a breach between the  
2 first and second water seals.
- 1 37. The device of claim 26 wherein the first region is coated with chromium oxide  
2 wear resistant coating.
- 1 38. The device of claim 26 wherein the brush block comprises graphite and copper.
- 1 39. The device of claim 26 wherein the brush block comprises four or more discrete  
2 radial segments.

1 40. The device of claim 39 wherein the brush block segments are held against the first  
2 surface with a spring that can be unhooked to remove the brush block segments.

1 41. The device of claim 35 further comprising a port between the first and second  
2 water seals whereby in the event the first seal is breached the water may flow out of the  
3 port thereby reducing the pressure on the second water seal.

1 42. A magnetron having a first and second endblock and a rotating target tube, the  
2 first endblock comprising:

3 a motor;

4 a gearbox electrically isolated from the motor;

5 a driveline within a first inner housing and having an insulating member  
6 connecting the gearbox to the target tube;

7 a first outer housing containing the first inner housing and electrically isolated  
8 from the first inner housing.

1 43. The magnetron of claim 42 further comprising a shield electrically isolated from  
2 the first outer housing.

1 44. The magnetron of claim 42 wherein the shield comprises an outer shield  
2 electrically isolated from an inner shield.

1 45. The magnetron of claim 42 wherein the second endblock comprises a water  
2 cooled electrical transfer system within a second inner housing.

1 46. The magnetron of claim 45 wherein the water cooled electrical transfer system is  
2 within a second outer housing and is electrically isolated from the second outer housing.

1 47. The magnetron of claim 44 wherein the outer shield protects against heat energy  
2 and wherein the outer shield reflects a first fraction of the heat energy in a vacuum and  
3 radiates a second fraction of heat energy in a vacuum towards the inner heat shield.

1 48. The magnetron of claim 47 wherein the inner heat shield receives the second  
2 fraction of radiated heat energy and radiates a third fraction of the heat energy towards  
3 the first outer housing.

1 49. The magnetron of claim 48 wherein the primary housing is internally cooled with  
2 forced air.

1 50. An endblock of a cylindrical magnetron having a target tube supplied with an  
2 electrical potential, the endblock comprising:

3 an isolation plate having a groove;

4 a shield electrically isolated from the isolation plate and the target tube and  
5 positioned between the groove and the target tube such that stray material on a trajectory  
6 from the target tube cannot completely fill the groove.

1 51. The endblock of claim 50 wherein the unfilled portion of the groove forms a  
2 shadow space preventing electrical transfer between the heat shield and the isolation  
3 plate.

1 52. The endblock of claim 50 wherein the unfilled portion of the groove forms a shadow  
2 space preventing electrical transfer between the electrical potential supplied to the target  
3 tube and other components of the magnetron.

1 53. A magnetron including a rotating target tube for sputtering onto a substrate  
2 comprising:

3 a first endblock having means for rotating the target tube, the means for rotating  
4 the target tube moveable to accommodate imperfections in the rotation of the target tube.

1 54. The magnetron of claim 53 further comprising a second endblock comprising  
2 means for providing electricity to the target tube, the means for providing electricity  
3 having water cooling means to cool the second endblock and the target tube.

1 55. The magnetron of claim 53 wherein the means for rotating the target tube  
2 comprises interlocking male and female components.

- 1 56. The magnetron of claim 54 wherein the second endblock further comprises  
2 means for supporting a stationary magnetic array within the target tube.
- 1 57. The magnetron of claim 53 wherein the means for rotating the target tube  
2 comprises means for electrically isolating the target tube from the sputtering process.
- 1 58. The magnetron of claim 54 wherein the first and second endblocks further  
2 comprise a means for shielding the endblocks from the sputtering process.
- 1 59. A magnetron having an endblock comprising a water cooled electrical transfer  
2 system within an inner housing, the inner housing within an outer housing and electrically  
3 isolated from the outer housing, the outer housing electrically isolated from a shield  
4 around the outer housing.  
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